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EFFECTS OF BORROWING FROM COMMERCIAL LENDERS ON FARM ORGANIZATION

**with particular reference to
fertilizers, buildings, machinery,
livestock, and operating expense**

**C. B. BAKER
and
G. D. IRWIN**

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Effects of Borrowing on Farm Organization

C. B. BAKER and G. D. IRWIN¹

CHANGES IN THE TECHNOLOGY OF PRODUCTION and in the nonfarm economy have imposed major adjustments on farmers. The dominating changes in technology have been increases in mechanization and in the use of nonfarm sources of fertilizers, while the dominating changes in the nonfarm economy have been inflation. Inflation has increased the price of items bought by farmers, but has failed to increase commensurately the price of farm products. Fortunately for agriculture, the nonfarm economy has generated high levels of employment that have made possible an unprecedented off-the-farm migration of surplus labor.

CHANGES IN FARM ORGANIZATION

Between 1948 and 1958, the average Illinois cash-grain farmer increased his output per man-hour 37 percent and the feeder cattle-hog farmer increased his 44 percent (1).² Part of the increase in output was due to an increase of 24.3 acres in the size of the average farm (161.0 to 185.3 acres). Mechanization permitted farmers to enlarge and consolidate farms without departing from the traditional one- or two-man farm. The total number of farms in Illinois dropped from 196,614 to 173,750. An average of 2,286 families have thus discontinued farming each year. The rate appears to have accelerated toward the end of the period.

Between 1945 and 1954, the number of tractors increased by 50.4 percent. The size of tractors farmers bought also increased (1). Tractor-powered machinery showed a similar increase. Much of the increase in mechanization has occurred heretofore in field crop enterprises. A corresponding increase in mechanized livestock enterprises now seems likely.

Annual outlays for commercial fertilizers increased 662 percent in the 1945-1954 period. The use of nonfarm sources of fertilizer has increased cash expenses and has permitted an increase in specialization. The simpler production organization of specialized farms encouraged still more an increase in the size of farms.

¹C. B. Baker, Professor; and G. D. Irwin, Research Assistant, Department of Agricultural Economics.

²Numbers in parentheses refer to literature cited.

The increasing volume of production per man was hardly enough to offset the unfavorable trend of prices that farmers received and paid. The saving feature for farmers who own land has until recently been an increase in land values caused by demand for land to increase the size of farms. Increased land values have raised equity positions and furnished more collateral when money is borrowed for further enlargement. The changes have altered the capital structure and increased the amount of total capital that the individual farmer requires. With new machinery, increased use of fertilizer, and larger livestock operations, the percent of total investment represented by land has fallen. But the total number of dollars invested for the whole farm has risen.

During the period, capital investment on cash-grain farms increased from \$63,100 to \$104,400. On feeder cattle-hog farms, the increase was from \$46,930 to \$66,630 (1). Because of these changes, farmers in the future are likely to be confronted with an increasing problem of controlling enough capital to establish economically optimum farm organizations. Meanwhile, the individual family farm remains overwhelmingly dominant.

At the same time, cultural differences between farm and nonfarm families have diminished. General access to television, radio, telephone, transportation facilities, and household utilities has reduced aspirational differences between farm and nonfarm families. Consequently, the cash cost of family living has increased. Moreover, these expenditures tend to be highly inelastic with respect to changes in income (3). As a result, a larger fixed sum from farm income is needed to meet living expenses before any funds are available for investment.

Farmers obtain capital funds primarily by saving from current income, leasing arrangements, and by borrowing from the loan agencies available to them. Loan agencies have changed little in a structural sense except for a strong increase in specialized loans on farm machinery. Thus while production and family living requirements have changed greatly over the past decade, methods of financing have not.

LOCATION AND PLAN OF THE STUDY

Financing limitations may deter farmers from attaining an economically optimum organization. This may be true if they find it necessary to use noncommercial lending agencies, such as merchants or dealers, to supply the capital they need to finance their operations, or if commercial lenders, such as banks and production credit associations, restrict loans to finance ventures profitable for the farmer but unattractive to the lender.

The use of fertilizers may well be an example of conflict of interest between the farmer-borrower and the nonspecialized lender. Fertilizers create no assets until the crop is harvested. Because of this characteristic, the financing of fertility outlays was contrasted with the financing of asset-creating ventures to determine what differences did exist and their consequences for farm organization.

The purpose of this bulletin is to compare quantities of resources that maximize farm profits with limits of commercial lenders in financing purchases of such resources. Differences among resources in lending limits might be expected to influence the organization of a farm where the operator is dependent on the use of credit. Because lender behavior might vary by type of area, the study included both a cash-grain and a livestock area (Fig. 1).

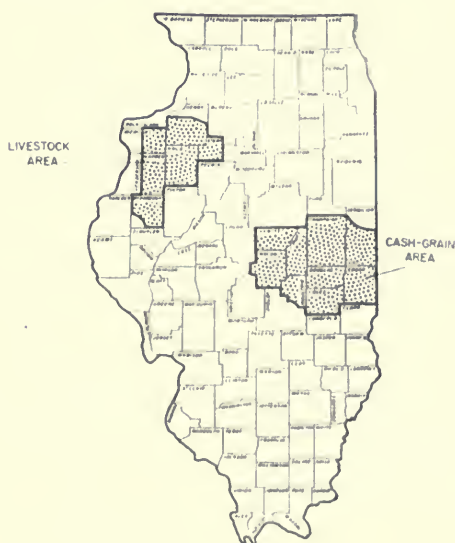
In 1954, nearly 70 percent of all farmers in east-central Illinois received more than half their farm income from the sale of crops, while in west-central Illinois less than 30 percent of the farmers received as much as half their farm income from crop sales, as the following figures indicate.

	Cash-grain farms as percent of all farms		
	1949	1954	Change
East-central Illinois.....	62.0	69.7	7.7
West-central Illinois.....	21.5	29.4	7.9

(Source: U. S. Census of Agriculture, 1954)

Location of cash-grain and livestock areas.

(Fig. 1)



During the preceding five years, farms reported as cash-grain increased by about the same percentage in the two areas.

Despite these differences in organization, there appears to be little difference in soil productivity or climatic factors. Rainfall and temperature in the two areas are very similar, as the following figures indicate.

	Long-term means	
	East-central Illinois	West-central Illinois
Precipitation, annual.....	33.95 inches	32.14 inches
Precipitation, March through September.....	26.44 inches	25.99 inches
Temperature, mean annual.....	49.9 degrees	50.6 degrees
Number of days between spring and fall, temperature of 32 degrees.....	152 ^a	151 ^b

Source: Climatological Data: Illinois Annual Summary, 1958.

^a Mean for six stations in east divisions of Illinois weather stations.

^b Mean for six stations in west division of Illinois weather stations.

The cash-grain area is split slightly below its north-south center by a 51° isotherm line that runs generally through the area from northwest to southeast. It lies largely between isoprecipitation lines of 35 inches to the north and 40 inches to the south. The livestock area, on the other hand, lies mostly on the north side of the 51° isotherm line and is split by the 35-inch isoprecipitation line. The isotherm line runs generally west to east through the livestock area; the isoprecipitation line makes a U-shaped curve through the area. The weather data suggest that climatic differences are actually slight. The climate is favorable for all crops produced in either area. The variation may be slightly greater, especially in precipitation, in the west-central livestock area, but it is not believed to have an important effect on choice of farm enterprises.

The dominant soil association in the cash-grain area is Drummer-Flanagan; in the livestock area, Tama-Muscatine. Between the two soil associations there is little or no difference in response to fertilizer inputs for commonly produced crops. Both soil associations are among the most productive to be found in Illinois.

Resource productivities were estimated with data from records kept by farmers who cooperated with the University of Illinois in an account-keeping project. These estimates were used to compute optimum quantities of the resources to use. Financing limits for the resources were estimated with data obtained in an interview survey of commercial lenders.

USE OF RESOURCES FOR MAXIMUM PROFIT

In 1957, 400 farmers in the cash-grain area and 299 in the livestock area cooperated with the University of Illinois in an account-keeping project. (For each area, the distribution of account-keepers by returns to management and capital is given in Table 1.) Studies at this University suggest that using records kept by record-keeping farmers tends to exclude the extremely high- and low-income commercial farms. In other respects, record-keepers represent fairly well the population of commercial farms defined in similar terms.

Among all the farmers who cooperated in the account-keeping project, it was thought that borrowers would be more likely to be found among those with low levels of income than among those at the relatively high levels. The financial condition of the low-income farmer makes his situation more sensitive to lender decisions at reasonably low loan levels.

For these reasons, the records of farmers in each area who earned \$5,000 or less as returns to capital and management in 1957 were used as the basis of all subsequent analyses and estimates. There were 140 such cash-grain farmers and 85 livestock farmers, or about a third of the account keepers in each area.

Productivity estimates

From records of the 140 farmers in the cash-grain area and the 86 in the livestock area who earned \$5,000 or less as returns to capital and management in 1957, tabulations were made of the value of farm output and various categories of inputs resulting from their farming operations. A multiple-regression equation was fitted relating the level of farm output to the amounts of inputs used.¹ The Cobb-Douglas type equation (5) used gives for each category of input a coefficient that represents the percent that value of output is increased by an increase of 1 percent in the use of the corresponding input. The equation assumes diminishing marginal productivities for all inputs. Thus, each successive input for a resource produces less than the preceding unit, given a fixed amount of the other inputs available to combine with it.

All categories of resources relevant to the study are expressed as annual expenses except the investment in machinery, which is expressed as a capital or inventory item (Table 2). Capital items are

¹ In the analysis, three other variables were included: land capital inventory, labor input, and machinery expense. Output included sales, ending livestock inventory, plus change in inventory of grain, feed, and seed (4).

Table 1. — Distribution of Cooperating Account-Keeping Farmers by Level of Income: East-Central Cash-Grain Area, and West-Central Livestock Area; 1957

Returns to capital and management	Cash-grain area		Livestock area	
	Number	Percent of total	Number	Percent of total
Under \$0.....	22	5.5	8	2.7
\$0–2,500.....	45	11.2	33	11.0
\$2,501–5,000.....	73	18.3	45	15.1
\$5,001–7,500.....	72	18.0	57	19.1
\$7,501–10,000.....	74	18.5	42	14.0
\$10,001–15,000.....	67	16.8	62	20.7
\$15,001–20,000.....	29	7.2	29	9.7
Over \$20,000.....	18	4.5	23	7.7
Total.....	400	100.0	299	100.0

Table 2. — Productivity Estimates for Selected Classes of Resources on Farms With Returns of \$5,000 or Less to Capital and Management: East-Central Cash-Grain Area and West-Central Livestock Area; 1957

Class of resource	Percent increase in output from one-percent increase of resource input (b_i)	Error estimate for rate of percentage increase (S_{b_i})	Increase in value of annual output from one dollar increase of resource (MVP_i) ^a
East-central cash-grain area			
Building expense, annual.....	.0657 ^b	.03887	.93
Soil fertility inputs, annual.....	.0704	.02688	1.82
Livestock and feed, annual ^c	.0701	.01032	.44
Operating expense, annual.....	.1884	.06860	2.98
Machine investment, inventory..	.1608	.04697	.63 ^d
Machinery expense, annual.....	.2750	.07142	2.53
Labor input, annual.....	.3100	.08582	2.06
West-central livestock area			
Building expense, annual.....	.0159 ^b	.02860	.31
Soil fertility inputs, annual.....	.0147 ^b	.01003	1.35
Livestock and feed, annual ^c	.4438	.02576	.94
Operating expense, annual.....	.0748	.05959	1.58
Machinery investment, inventory	.0622	.03390	.36 ^d
Machinery expense, annual.....	.0693	.05995	.99
Labor input, annual.....	.0997 ^b	.08006	.86

^a Evaluated at geometric means of the variables.

^b Not significantly different from 0 at 5-percent level.

^c Beginning livestock inventory plus purchased livestock and feed.

^d Should not equal \$1 at optimum with unlimited capital available to acquire resources. To make such a comparison requires equating \$1 with the sum of annual increase, properly discounted, over life of inventory. Over 5 years, for example, with a discount rate of 5 percent, the sum is \$2.72 in the grain area and \$1.56 in the livestock area.

normally expected to produce a return on the investment only, while annual expenses must return at least as much as their cost to be profitable. Thus the coefficient for machinery investment can not be interpreted in the same way as the coefficients for the other categories. Capital invested in machinery would have to produce enough income to cover only the annual expense associated with use (mainly depreciation) and a return on the investment. An annual input, such as starter fertilizer, would require a return of at least a dollar for a dollar spent.

Regression coefficients are given in Table 2, column 1. The statistical significance of each coefficient is judged by comparing its size with its variability. Variability is measured by the size of its error estimate (Table 2, column 2). In both areas, all coefficients differ significantly from zero except building expense and, in the livestock area, soil-fertility inputs.

From the regression coefficients, estimates can be obtained for the addition to income resulting from \$1 additional input in the various categories of resources.¹ These estimates are given in Table 2, column 3. An exception to this interpretation has already been noted for machinery investment. To make the productivity value of machinery comparable with other values requires that the number indicated be multiplied by the reciprocal of the annual rate of depreciation.

Obtaining maximum profits

The estimates indicate that the grain-area farms with returns of \$5,000 or less to capital and management in 1957 would get returns of \$.93 for the next dollar spent in building inputs, or \$1.82 for every dollar of input for soil fertility if other input levels were to remain constant at the average (Table 2, column 3). Since annual inputs should return at least dollar for dollar, the figures indicate that building inputs should be reduced, but that fertilizer is a profitable input, as are operating and machinery expense.

On the livestock-area farms, more available manure reduces the return on fertilizer to \$1.35 per dollar spent, but adding more would still be profitable. Building and machinery expense would need to be reduced, but operating expense could profitably be increased.

On both types of farms, output could be increased by spending for several different inputs. The use that gives the highest return per added dollar spent (value of marginal productivity) is most profitable. The marginal productivities shown in Table 2 are for a farm with

¹ This is done by multiplying the regression coefficient by the fraction $\bar{Y}/\bar{X}_i$, where $\bar{Y}$ is the geometric mean of output over all farms of record and $\bar{X}_i$ is the geometric mean for the input to which the coefficient refers.

resources used at levels shown by the records to be average. The marginal productivities refer to increasing a single input with other input levels held constant.

If unlimited capital were available, it would be profitable to adjust all variable inputs to the point where added returns equal the cost of added input. With limited funds, the expenditure of each dollar should be for the resource with the highest marginal value of productivity.

The quantities of resources that, according to the functions should be used to maximize profits, are given in Table 3, columns 1 and 4.¹ Each of these quantities would be optimum if all other resources were limited to the average amounts available. They do not represent the optimum input if the six categories of inputs were adjusted at the same time. Nor do they necessarily represent the wisest use of each additional dollar.

Table 3. — Actual and Optimal Rates of Use for Resources: East-Central Cash-Grain Area and West-Central Livestock Area; 1957

Class of resource	Grain area			Livestock area		
	Optimum quantity ^a	Actual quantity ^b	Optimum minus actual	Optimum quantity ^a	Actual quantity ^b	Optimum minus actual
Building expense...	\$1,355	\$1,436	\$ -81	\$ 455	\$ 1,473	\$-1,018
Soil fertility.....	\$1,525	\$ 801	\$ 724	\$ 430	\$ 318	\$ 112
Livestock and feed ^c	\$1,332	\$3,317	\$-1,985	\$12,329	\$13,719	\$-1,390
Operating expense..	\$5,022	\$1,311	\$ 3,711	\$ 2,264	\$ 1,379	\$ 885
Machinery investment.....	\$3,042k ^d	\$5,326		\$ 1,692k ^d	\$ 5,071	

^a Rate at which \$1 additional expense returns \$1, assuming other resources used at level of geometric means.

^b Geometric mean of values for farm records used.

^c Beginning livestock inventory plus purchased livestock and feed.

^d The investment optimum must be adjusted to annual basis by a factor "k" which accounts for the depreciation rate and rate at which to discount future returns.

The average quantity of resources in each category actually used is given in Table 3, columns 2 and 5. As would be expected, the greatest difference between the two groups of farms is found in the livestock-and-feed and soil-fertility inputs. The lower outlays for soil-fertility inputs in the livestock area reflect the complementary relation between livestock and crop systems of farms in the area. With substantially

¹ The estimate of optimum machinery investment seems unduly large in the grain area. This is due partly to the fact that it is stated in terms of inventory, or capital sums, instead of an annual input, as in the case of the other resources. Otherwise, there doubtless are correlations between machinery investment and variables omitted from the equations. No good explanation is available for the apparent difference between grain-area and livestock-area farms.

less livestock, farms in the cash-grain area are shown to spend more on soil fertility.

When the optimum rates are compared with the rates of actual use, the livestock farms appear to have been closer to an optimal organization than the grain farms. Both types of farms exhibit a relative "overuse" of resources for livestock and feed. The size of variation on the individual records, however, leads to caution in ascribing much significance to the extent of overuse in the livestock area. Outlays on buildings likewise are relatively too high for profit maximization in both areas, though not greatly so in the grain area and perhaps not significantly so in the livestock area.

The pattern of difference between optimum and actual rates of use of resources suggests the possibility of some basic differences between outlays for resources that are shown to be overused and those that are underused. One hypothesis is that it is easier to finance outlays that entail the creation of assets — buildings, livestock, machinery — than it is to finance outlays that do not create assets — fertilizers and operating expense.

BORROWING AS A SOURCE OF CAPITAL

Farmers are impelled to acquire and allocate resources on the basis of relative productivity. If an expenditure of \$100 on fertilizer adds more net income than \$100 spent on livestock or machinery, the farmer is led to buy fertilizer. In fact, in the absence of capital limits, the farmer would continue buying fertilizer until he reached the point at which increases in expected income equal the cost from added fertilizer purchases. Limited in capital, he would stop buying fertilizer when additions to net income from the use of fertilizer equals additions to net income from the next most profitable use of capital.

Exposure of equity

More than twenty years ago Professor Kalecki (2) developed the "principle of increasing risk." This principle shows logically the possibility of a restriction on the size of firms from exposure of equity or net worth. Exposure of equity results from using borrowed funds. Consider two farmers whose positions of equity are equal, but one is in debt and the other is not. For a given variation in the prices of assets, the percentage of variation in equity is higher for the indebted farmer than for the debt-free farmer. Even though alike in all other respects, including expectations on uncertain outcomes, it seems likely they would still differ in the selection of a course of action. The indebted farmer could be expected to be more cautious, if only to protect the equity he has.

His cautious behavior might be reflected in several ways. One might be through adopting alternatives that yield outcomes in shorter periods of time. Another might be to adopt alternatives with relatively small variation in probable results. Still another way might be to make a decision on the basis of some notion of control of loss in place of, or in addition to, profit maximization. In any case, the result is an organization of resources different from that yielded by perfect knowledge and profit-maximizing motivation.

Cost of loans and restraints on borrowing

Loan costs are comprised of interest, closing costs, and whatever side effects may be created in the farm organization by the lender's requirements for collateral. The importance of closing costs depends primarily on the amount and length of the loan. The effect of a modest closing cost, by size and length of loan, on effective interest rates is shown in Table 4. The figures are based on the assumption that the closing cost is deducted from the loan proceeds and that interest and principal are paid at maturity of the loan. Paying closing costs in cash or with an added loan would slightly lessen the increase in effective interest rate. Deducting the interest at the time the loan is disbursed, or making payments on the loan before maturity, would increase the additions to contract interest rate. A combination could, of course, change the increase substantially. For large loans or long terms, the addition would be negligible.

The figures indicate that for loans that are small or for a short term, the contract rate of interest is not likely to be as important as the items included in closing costs. On the other hand, as the size or length of loan increases, whether the effective interest rate itself is very impor-

Table 4.—Amounts Added to Contract Interest Rate per Year by a Closing Cost of \$15: Selected Sizes and Lengths of Loans*

Months	Principal			
	\$100	\$1,000	\$10,000	\$100,000
	<i>perct.</i>	<i>perct.</i>	<i>perct.</i>	<i>perct.</i>
1.....	211.8	18.2	1.8	.18
3.....	70.6	6.0	.6	.06
6.....	35.3	3.0	.3	.03
12.....	17.7	1.5	.15	.02
36.....	5.9	.5	.05	...
60.....	3.5	.3	.03	...

* Change (increase) in effective interest rate is calculated by $\Delta i = \frac{\$15/(p-15)}{t/12}$ where i = annual interest rate; p = amount of the promissory note; t = number of months in length of loan.

tant as a determinant in a farmer's decision to borrow becomes doubtful. Of far greater importance is the profit expectation he holds on the venture to be financed and the operational restraints imposed on him as a result of borrowing.

Among the restraints, the most important are those reflected legally and psychologically by a chattel mortgage. So long as borrowing is based on an unsecured promissory note, the borrower is faced with a minimum of operational restraint; he merely agrees to repay the loan with interest. As the lender secures assets in chattel mortgages, however, the borrower (1) is prohibited from using the assets elsewhere as first-mortgage chattels; and (2) is accountable to the lender for income received from sale of the assets. The first restraint operates to limit the borrower's access to funds from other sources. The second may inhibit the flexibility of his marketing program. Both may make the farmer averse to borrowing to improve his farm organization. This aversion may be reinforced psychologically by the fact that a chattel mortgage is a matter of public record. It may lead the farmer to use alternate financing methods, such as leasing or custom hire.

The restraining effect of a chattel mortgage is reduced, however, when it is restricted to a few assets, or perhaps to one alone. An example of the restriction to a few assets is a feeder-cattle loan where the chattels are often limited to the cattle plus the feed required to finish them. An example of a chattel mortgage restricted to one asset is a machinery loan where the secured asset may be the machine, perhaps on a conditional sales contract. Such limited chattel pledges are attractive to the borrower. These kinds of loans are also attractive to lenders.

FACTORS AFFECTING LENDER DECISIONS

Lending policy

The farmer's use and allocation of resources may be affected by lender decisions as well as by legal and psychological factors. A borrower may abandon a project on recommendation of a lender that he do so. Or a lender may refuse to finance assets required for one project but agree to finance assets for another. It is apparent also that any loan adds generally to the sum of assets available to the farmer. Thus, to expand one project with borrowed funds may also make possible an expansion of another project with the use of resources already on hand.

The fact that this possibility exists has led to the fallacious conclusion that credit available to farmers is completely fluid or nonspecialized. What difference does it make that a farmer finances feeder cattle more easily than fertilizer purchases if he simply uses his borrowing

power to finance cattle and his other resources to buy fertilizer? It makes no difference as long as the attainment of a profit maximum is unaffected by the total capital plus borrowing power available to the farmer. However, if profit maximizing is restricted by ability to borrow, it does make a difference.

Financing assets that create new borrowing power substantially lifts the restriction on profit maximizing. Financing assets that do not have this effect "absorbs" the farmer's equity at a rapid rate. To finance feeder cattle for a financially substantial farmer with an adequate feed supply may absorb but little of the borrowing capacity created by his equity. To finance a fertilizer purchase, creating no increase in pledgeable assets, may result in a heavy absorption of the equity the farmer had prior to the loan.

A difference in chattel requirements may also be related to the type of farming dominant in the area. Thus, a farmer in a cash-grain area may not be able to borrow as much to finance livestock as he would be able to do if he were in a livestock area. Whether these results materialize depends on lender response to loan applications for financing these various activities.

As a lender appraises a loan application from a farmer, he necessarily uses several factors on which to base his decision. These are sometimes popularly referred to as the "3 C's" of lending policy — character, capacity, and collateral of the borrower. Much stress is laid on character. Much is said about the need to put more weight on the income-producing ability of the farmer, his capacity to repay. The third, however, is necessarily the "clincher" — necessarily because the loan contract itself is a dollar-fixed commitment on the part of the borrower and is not directly related to his income expectations or those of the lender with respect to the financed venture. Hence, the lender is primarily interested in the first two "C's" insofar as they assure him that he is not likely to have to resort to a claim on the borrower's assets to collect the loan.

On the other hand, weakness in collateral can lead to refusal of the loan irrespective of strength of character and capacity. There is a fundamental difference in purpose between the borrower, who is demanding a loan on the basis of expected income, and the lender, who is restrained by his lending circumstance to a "net asset" appraisal. Moreover, this difference can lead to nonoptimum organization of resource services financed with loan funds.

Maximum profit for the lender

This view of the lender's criteria for appraisal is reinforced by consideration of the economic consequences for him of a lending transaction. Like the farmer, the lender is confronted with an optimizing problem in the allocation of his lending funds. Within limits set by institutional restraints and his own prudence, he has a loanable fund to allocate among various public and private borrowers who offer securities in the form of bonds, stocks, mortgages, sales contracts, warehouse receipts, and so on. The fundamental conditions for optimum may be the same for the commercial lender as for the farmer. The lender may, therefore, be expected to allocate his loan funds in such a way as to get maximum income from the alternate investment outlets available to him.

For many investment outlets, especially government bonds, the costs of the lending transaction are very small. Also, repayment is nearly certain and involves a minimum of administrative and collection cost. Hence, returns from agricultural loans must be sufficient to offset those available from these attractive investments and also to repay added costs of administering the more troublesome loans. Moreover, the return on a conventional loan is fixed at a level that permits the commercial lender practically no margin with which knowingly to incur a risk. A return of \$6 on a \$100 loan held for a year means very little if the lender is highly uncertain of repayment.

Effects of a mortgage

It is not likely that the commercial lender will or can appraise a loan application, at least for some applicants, without taking into account the proposed use of the funds. Use may not be too important if the borrower has enough collateral to be able to borrow on an unsecured note. But as the collateral position of the borrower weakens, the likelihood increases that use will be important. As soon as the lender finds it necessary to secure the note with a chattel mortgage, he finds it necessary to differentiate between loans that add to tangible assets in the sense of being pledgeable assets and those that do not.

Machinery and livestock loans are examples of pledgeable assets, while loans to finance fertilizer or general operating expenses are not. Both types may be income producing in the expectation of both borrower and lender. Yet in his appraisal the lender is likely to differentiate between those loans whose proceeds yield chattel assets during the loan period and those that do not.

HOW ESTIMATES OF LOAN LIMITS WERE OBTAINED

To estimate lender response to loan applications, at least two observational techniques were possible — asking lenders a set of “attitude” questions covering points that influence their decisions, or making a simulated request for a loan. Because of the difficulty of framing good questions and the danger that the respondents would reply to the questions in the way they thought the interviewer expected them to and thus give erroneous information, the simulated request for a loan was the method chosen.

From records at hand, a farm was synthesized for each area in terms of assets and liabilities (Table 5). The farms are identical in current, intermediate, and net worth. However, they do differ in detail. Three additional criteria guided the synthesis. The various categories of assets needed to be similar to the average farms for which productivity estimates were made (Table 3). The farms needed to appear familiar to lending officers in each of the two areas. Finally, the farm descriptions needed to be consistent with a reasonable lending situation. Specific descriptions of machinery and livestock inventories, payments due on debts, past crop yields, and other items relevant to a loan request were developed to fit the financial summaries.

Table 5. — Financial Summaries for Farms Used as Basis
of Loan Requests: East-Central Cash-Grain Area
and West-Central Livestock Area, Illinois

Item	Area	
	East-central, cash-grain	West-central, livestock
Cash.....	\$ 1,431	\$ 250
Cash value of life insurance.....	\$ 910	\$ 279
Farm feeds.....	\$ 1,571	\$ 1,935
Market livestock.....	\$ 6,784	\$ 8,688
Current assets.....	\$10,696	\$11,152
Other livestock.....	\$ 398	\$ 1,040
Machinery and equipment.....	\$ 8,492	\$ 7,394
Working assets.....	\$ 8,890	\$ 8,434
Real estate.....	\$38,125	\$38,125
Total assets.....	\$57,711	\$57,711
Open account, grain elevator.....	\$ 620	\$ 1,152
Note on cattle.....	\$ 5,500	\$ 5,500
Fertilizer loan.....	\$ 282	\$ 206
Current liabilities.....	\$ 6,402	\$ 6,858
Machinery purchase contract.....	\$ 3,125	\$ 2,669
Real estate mortgage.....	\$19,684	\$19,684
Total liabilities.....	\$29,211	\$29,211
Net worth.....	\$28,500	\$28,500
Current worth.....	\$ 4,294	\$ 4,294
Intermediate worth.....	\$10,059	\$10,059

Interview procedure

To obtain loan estimates, the interviewer identified himself to the farm lending officer, enlisted his cooperation in the research, and suggested the following lending situation.

A potential customer purchased 80 acres with assurance of being able to rent an additional adjoining 160 acres from the same landowner on a crop-share lease. Location was approximately specified in the lender's community to control the mental picture of land type in all interviews. It was suggested that this man's father had rented the 160 acres for many years before retiring, but did business in another nearby town. Hence, the lender would not be personally acquainted with the family.

The young man was 31 years old, married with two children, and farm reared on rented land. Husband and wife had done factory work for four years to acquire capital, and had set up farming on 160 acres in a neighboring county without any parental aid. Livestock experience had included feeding 25 head of steers the past two years and raising 10 litters of hogs each of the last four years. Income had been supplemented with off-farm labor as much as possible. This background and the financial statement suggested that the young man was a capable and industrious operator, making good progress financially. To the lender, his character was good.

Upon presentation of this situation, the lender was asked to assume the farmer described desired to become a customer. Financial statements were provided together with any other information requested by the lender. It was suggested that the farmer felt the present financial structure would permit a minimum operation without borrowing, but that faster financial progress could be made with the use of borrowed funds. Hence, it was proposed that five alternative loan requests be considered in turn (randomly ordered between interviews) and that it be assumed the remaining needs could be met from available funds. Maximum available loan and the terms for the first loan purpose, machinery, for example, were determined and recorded. Then the interview reverted to the preloan situation and a second loan purpose, say buying feeder cattle, was considered. The process was repeated for each of the other purposes.

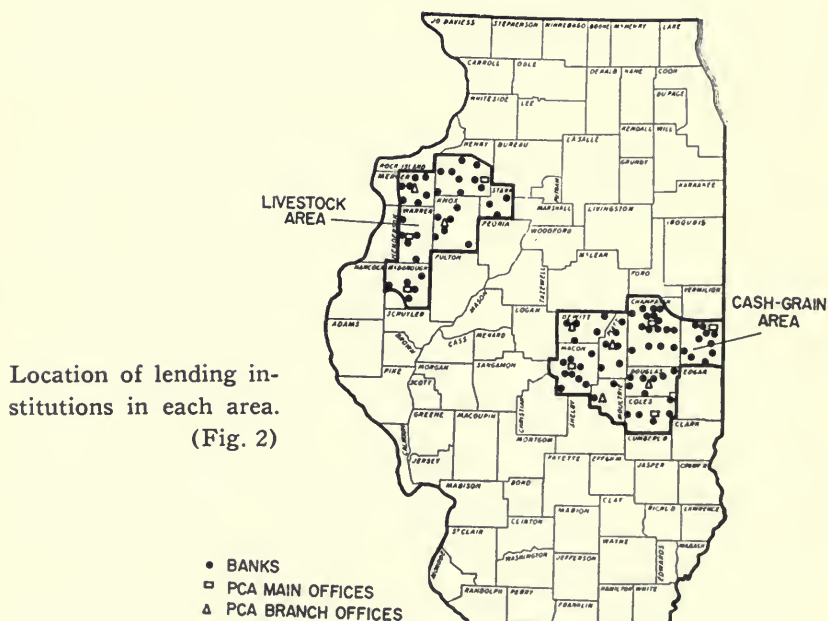
The proposed use of funds for each purpose was worked out and was plausibly spelled out to the lender. For example, the request for purchase of machinery was for the larger equipment needed in going from a 160- to a 240-acre operation, and for replacement of old machines included in the machinery inventory. Similar justification was made for other requests.

In each case, the initial loan request was for an amount greater than believed obtainable. This was done in the hope of obtaining less "interviewer-conditioned" responses than might be obtained by successfully increasing requests until a cutoff was obtained. It was hoped that this approach might suggest naivete of the interviewer and thus allow the lender to use his correct judgment in "teaching" a realistic evaluation.

Lenders interviewed

Lending officers were interviewed in 21 lending institutions in each area: 9 in small banks, 8 in large banks, and 4 in production credit associations. Locations of all institutions in each area are shown in Fig. 2.

Interviews were started in September and completed in October. Timing the interviews was a critical problem. Much of the methodological value of the observational technique rested on preserving the context of an actual lending situation. Yet at any given time of the year,



loan applications would be more appropriate for some purposes than for others. Financing feeder cattle reaches a peak of activity in the fall, our observational period. Machinery financing might be expected to be at a seasonal low. To take into account the effects of seasonal variations on lender response would have required considerably more time and resources than were available for the research.

LOAN LIMITS ESTABLISHED BY INTERVIEWS

Loan limits established by the interview procedure just outlined were tabulated for each type-of-lending institution in each area. The arithmetic means are reported in Table 6. It was originally intended also to observe any differences between types of loan in interest rate, use of chattel mortgage, length of loan, and so on. Our intent was to see if changes in such terms as these might be associated with limits established on loans and with purpose of loan. This attempt, however, was unsuccessful. The response generally implied that, for a given borrower and purpose, the central question was approval of the loan and that the terms other than loan limit were subsidiary considerations, being set by general policy of the institution in question; that is, for purpose A, a loan was possible to a limit of a certain number of dollars.

Table 6. — Mean Maximum Borrowing Limits, by Type of Lender and Proposed Use of Loan Proceeds: East-Central Cash-Grain Area and West-Central Livestock Area; 1959^a

Area and agency	Purpose					
	General operating expense	Machinery purchase	Feeder-cattle purchase	Buildings and building repair	Fertilizer purchase	All purposes
Grain area						
Small banks.....	\$2,167	\$ 844	\$5,944	\$ 867	\$ 934	\$2,151 ^b
Large banks.....	\$1,837	\$ 487	\$4,975	\$1,075	\$1,591	\$1,993 ^b
PCA.....	\$1,775	\$1,500	\$7,000	\$1,850	\$1,375	\$2,700 ^b
All agencies.....	\$1,966	\$ 833	\$5,776	\$1,133	\$1,268	\$2,195 ^c
Livestock area						
Small banks.....	\$1,478	\$1,167	\$6,128	\$ 322	\$ 624	\$1,944 ^b
Large banks.....	\$2,212	\$1,725	\$7,581	\$1,100	\$ 875	\$2,699 ^b
PCA.....	\$2,500	\$3,700	\$6,000	\$1,550	\$ 972	\$2,944 ^b
All agencies.....	\$1,952	\$1,861	\$6,657	\$ 852	\$ 786	\$2,422 ^c

^a Except as stated in the following footnotes, differences between areas and lending agencies for given loan types have not been tested for statistical significance.

^b The loan limit for all purposes, averaged for all production credit associations, exceeds the average for all banks with a difference significant at a 5-percent probability level.

^c The loan limit for all purposes, averaged for all agencies, does not differ between areas at an acceptable probability level.

Within this limit, the terms of loan tended not to vary in any way our observational technique was capable of capturing.

Varying interest rate or terms between borrowers with different amounts of assets was suggested by several bankers, however, and the interest rate was adjusted by bankers in the livestock area to favor feeder-cattle loans. These facts apparently reflected institutional policies set by farmer-controlled boards of directors. No variation in chattel commitments was noted between purposes, but collateral required by different lenders varied from signature on notes only to mortgages on all available chattels.

Considering the aggregate response of all institutions (Table 6, lines 4 and 8), no difference was observed between areas in limits of loans to finance general operating expense. Otherwise, there seemed to be a tendency for the limit to be higher in the livestock area for the purchase of feeder cattle and machinery. The limits tended to be higher in the grain area for fertilizer and for buildings and building repair.

In the livestock area, the production credit associations fixed loan limits somewhat higher than did either small or large banks for all types of loans except for purchase of feeder cattle. In the grain area, the production credit associations went higher than banks on feeder cattle, buildings, and machinery, but lower on general operating expense; they were higher than small banks and lower than large banks on fertilizer purchases.

Small banks, those without a competitive lender in the same town, were, on the average, more conservative than large banks for all types of loans in the livestock area. In the grain area, they were more conservative in financing outlays for buildings and fertilizer, but less conservative for feeder cattle, machinery purchase, or general operating expense. Thus it is difficult to conclude with certainty that competition among lending institutions as found in the large-bank category generally has the effect of reducing conservatism in the appraisal of loan applications.¹ Any such effect may be offset by the fact that those banks without a competitor in the same town were in the smaller farming communities and tended to be in closer contact with farming.

¹ All statements in these last three paragraphs must be tempered by reference to footnotes in Table 6, where probability levels are reported for differences found to be significant. Tests to establish the significance of difference take account of variations in response as well as the mean levels of responses reported in the body of the table.

ANALYSIS OF THE ESTIMATES

When loan proceeds are used to finance general operating expenses, no specific assets are created in the process. The same is true, though with some modification, when loans are used for fertilizer purchases. But when loans are used to buy machinery or feeder cattle, assets are created that are specific and tangible. This tends to be true also, though less so, for building outlays. Loans are therefore grouped without regard to type of lender into (A) asset creating, nonasset creating; (B) feeder cattle, machinery or buildings; (C) machinery, buildings; and (D) general operating expense, fertilizer purchase (Table 7, parts A through D). (Differences between areas for given classes of loans are given in Table 7, column 3 and the average maxima for given classes given in column 4.) Where the differences between areas are not significant at acceptable probability levels, it is entirely appropriate to average responses over both areas.

Asset-creating loans

All three types of loans that create assets are combined in Part A of Table 7. From the analysis of variance, it may be concluded that asset-creating loans are granted in significantly larger amounts than nonasset-creating loans. This distinction was stronger in the livestock than in the grain area. The asset-creating class was broken down in Part B to compare feeder cattle, which were thought to create added value at relatively the more rapid rate, with the rest of the aggregate. The difference is again highly significant. The remaining two components of the asset-creating class of loans, machinery and buildings, are compared in Part C. The difference here, too, is significant. The difference might be ascribed to institutional policies that restrict lending on real property. But there may also be an economic reason because of the relatively slower rate of turnover of building capital, as compared with machinery capital.

Thus, the asset-creating class of loans, in decreasing order of asset creation, includes feeder cattle, machinery, and buildings. The apparent reverse ordering of machinery and buildings in the grain area is not statistically significant. In the grain area, production credit association loans for each purpose were larger than bank loans by about the same percentage. But in the livestock area, the difference between production credit association and bank limits was much larger for machinery than for buildings. It has been suggested that this difference is due to variations in relative willingness to make machinery loans of longer than one-year terms.

Table 7. — Mean Maximum Loan Limits by Class of Loan: East-Central Cash-Grain Area and West-Central Livestock Area; 1959^a

Class of loan	Mean loan limit		Difference between areas	Mean loan limit for both areas
	Livestock area	Grain area		
A. Asset creating: machinery, feeder cattle, or buildings....	\$3,124	\$2,581	\$ 543	\$2,852
Nonasset creating: general operating expense or fertilizer purchase.....	\$1,369	\$1,618	\$ -249	\$1,493
Difference.....	\$1,755	\$ 963		\$1,359 ^b
Amount livestock area exceeds grain area.....	\$ 792 ^c			
B. Feeder cattle ^d	\$6,657	\$5,776	\$ 881	\$6,217
Machinery or buildings ^e	\$1,356	\$ 963	\$ 393	\$1,160
Difference.....	\$5,301	\$4,813		\$5,057 ^b
Amount livestock area exceeds grain area.....	\$ 488 ^f			
C. Machinery.....	\$1,861	\$ 833	\$1,028	\$1,348
Buildings.....	\$ 852	\$1,133	\$ -281	\$ 993
Difference.....	\$1,009	\$ -300		\$ 355 ^g
Amount livestock area exceeds grain area.....	\$1,309 ^g			
D. General operating expense.....	\$1,952	\$1,966	\$ -14	\$1,959
Fertilizer purchase.....	\$ 786	\$1,288	\$ -502	\$1,037
Difference.....	\$1,166	\$ 678		\$ 922 ^b
Amount livestock area exceeds grain area.....	\$ 488 ^f			

^a A split-split-plot analysis of variance model was used, with areas, type of lending agency, and purpose as factors.

^b Significant at 10-percent probability level.

^c Significant at 2½-percent probability level.

^d Illustrative of asset creation at a rate high with respect to loan level.

^e Illustrative of asset creation at a rate low with respect to loan level.

^f Not significant at acceptable probability level.

^g Significant at 5-percent probability level.

Nonasset-creating loans

The two components of nonasset-creating loans are compared in Part D of Table 7. These are loans for general operating expenses and fertilizer purchases. The limit on operating expenses was higher than the limit on fertilizer purchases. It may be difficult to find a plausible hypothesis for this. The difference is actually slight in the grain area, where heavy rates of fertilizer applications are much more common than in the livestock area. From comments made in interviews, it is suspected that lenders may feel that the need for financing general operating expense suggests lack of ability of the applicant to manage his financial organization. Yet they recognized also that meeting general operating expenses was a condition necessary to successful operation. Many lenders in the livestock area commented that fertilizer lending was a practice of recent origin and that they were being conservative because they lacked the knowledge of fertilizer responses to appraise the request.

CAN BORROWING MEET THE NEED?

That differences in loan limits exist between types of loans has been established. Do the differences agree with differences in optimum resource quantities in the two types of farm organizations? The estimates given in Table 8 are derived from Tables 3, 5, and 7. The resource quantities in each category available on the lending-situation farms is given in column 1; the loan limits established at means of lender responses are given in column 2. Columns 1 and 2 added together provide an estimate of the *maximum* quantity the applicant could command by using his *whole borrowing power*, alternatively, *for each* of five purposes. Thus the sum of columns 1 and 2 is more than the total amount that he could borrow.

Resource requirements and lending limits

The optimal resource quantities, according to productivity estimates established from the previously described farm records, are given in Table 8, column 4. These estimates reflect an optimum for the resource in the row of the stub, given all other resources available at the average level of inputs on the farms. The maximum quantities in column 3 are for the synthesized farm used in the lending situation. The figures may be compared since the synthesized lending-situation farm was based on the average farm of the productivity estimates. Their similarities are evidenced by the comparisons made in Table 9. Hence the comparison of the two sets of estimates provides an estimate of the possible effects of loan limits on the attainment of optimum farm organization.

The maximum resource quantities available to the applicant are subtracted from the optimum and the differences are given in the last column of Table 8. These figures must be interpreted carefully. They do not represent an attainable distortion of farm organization when taken together. Each figure must be taken by itself. Each estimate of optimum use assumes all other resources are fixed at average levels. Each estimate of maximum loan assumes no borrowing to finance other assets. A negative number means more of the resource is available than could be profitably used. A positive number means less of the resource is available than could be profitably used. The figures do not represent optimum use of each successive dollar.

Seasonal needs for funds

It seems clear that it would be relatively easy for the operator in either area to obtain a relative oversupply of livestock and feed, and of

Table 8. — Comparison of Optimal Resource Quantities and Quantities Owned and Capable of Being Financed: East-Central Cash-Grain Area and West-Central Livestock Area; 1959

Class of resource	Quantity on hand ^a	Mean loan limit ^b	Maximum quantity ^c	Optimum quantity ^d	Optimum less maximum ^e
Grain area					
Livestock and feed.....	\$ 8,355	\$5,776	\$14,131	\$ 6,370	\$-7,761
Machinery.....	\$ 8,492	\$ 833	\$ 9,325	\$15,210	\$ 5,885
Buildings.....	\$ 243	\$1,133	\$ 1,376	\$ 1,355	\$ -21
Fertilizer.....	\$ 272	\$1,268	\$ 1,540	\$ 1,525	\$ -15
Operating expense.....	\$ 916	\$1,966	\$ 2,882	\$ 5,022	\$ 2,140
Livestock area					
Livestock and feed.....	\$10,623	\$6,657	\$17,280	\$ 9,233	\$-8,047
Machinery.....	\$ 7,394	\$1,861	\$ 8,255	\$ 8,460	\$ -795
Buildings.....	\$ 19	\$ 852	\$ 871	\$ 455	\$ -416
Fertilizer.....	\$ 18	\$ 786	\$ 782	\$ 430	\$ -352
Operating expense.....	\$ 213	\$1,952	\$ 2,165	\$ 2,264	\$ 99

^a From Table 5, column 1: livestock and feed excludes other livestock; buildings include all real estate; cash on hand is allocated among buildings, fertilizer, and operating expense in the proportion shown optimal.

^b From Table 6: loan limits are in addition to debt already described in Table 5.

^c The sum, column 1 plus column 2.

^d From Table 3: for buildings, fertilizer, and operating expense, columns 1 and 4; for livestock and feed: column 1, this table, less deviation from optimum given in Table 3; for machinery: Table 3, column 4, with $k=5$ (see footnote 1, page 10, with reference to the estimate in the grain area).

^e The difference, column 4 less column 3.

Table 9. — Comparison of Structural Features of Farms Used in Productivity Estimates and in the Lending Situation

	Grain area		Livestock area	
	Productivity	Lending	Productivity	Lending
Total acres.....	257.7	240	227.4	240
Soil productivity rating.....	81.5	...	76.4	...
Beginning livestock inventory.....	\$4,535	\$5,282	\$9,067	\$9,945
Livestock purchase.....	\$1,924	\$3,148	\$5,280	\$3,218
Labor input.....	\$3,327	\$3,200	\$3,558	\$2,796
Annual machinery expense ^a	\$4,374	\$4,529	\$4,085	\$4,149
Returns to capital and management	\$2,192	\$2,504	\$2,457	\$2,246

^a Includes depreciation, machinery repairs, machine hire, fuel, and farm share of automobile expense.

machinery.¹ In fact, his controlled assets in these categories are already excessive. He would not seem particularly limited in access to finance for buildings and fertilizer in the livestock area. In the grain area, he nears his limit in these resources. It is concluded that in both areas he finds it difficult to finance the general operating expense at levels found optimum. It is presumed that his difficulty may reflect a belief on the part of lenders that operators should finance operating expenses out of their own cash and current income.

If this is true, it may be, as has long been suggested, that seasonal demands for cash comprise a determinant of farm organization. How strong it is would depend on the extent to which the farmer relies on his credit to finance his operation. The cases used in this study have been synthesized to insure that loan limits would be reached at levels that might affect the organizations. Many farmers are not so vulnerable to loan decisions. On the other hand, many farmers *are* just as fully exposed to them — some even more exposed.

The estimates in Table 8 do no more than suggest the possibility that there may be a connection between loan limits that differ by use of loan proceeds and the resource organization of farms. It may well be, also, that difficulty in financing operating expenses affects the farmer's distribution of cash and credit among the other resource categories. Further research may indicate the situations in which these conditions might be expected to occur.

SUMMARY

To study the effect of borrowing on the farmer's ability to get an optimum set of resources for his farm organization, two sets of estimates were made. First, the optimum use of resources was estimated for a specific farm in each of two areas — a grain area and a livestock area. Then estimates were obtained of the amounts of money that could be borrowed for resources for each farm.

The two sets of estimates were compared to determine how the amount of controllable resources compared with the most profitable amount for the farm. In both areas, more than enough funds were available for livestock and machinery.² On the average, enough could

¹ There is an apparent exception in the case of machinery on grain-area farms. However, see the methodological note with reference to this item given on page 10. In any event, the difference between optimum and maximum is reduced substantially if transformed to an annual basis.

² Except, possibly, for machinery on grain-area farms. See footnotes, pages 10 and 24 and footnote d, Table 8.

be obtained for fertilizer and buildings, but there was not enough money in either area for operating expenses. It was suggested that lenders may feel that good managers should be able to cover operating expense from their own funds.

The amount of money that could be borrowed varied widely between purposes. The largest loan in both areas could be obtained for feeder-cattle purchase. The smallest in the livestock area was for fertilizer, and in the cash-grain area, machinery. Large amounts of manure may reduce fertilizer needs in the livestock area. Experience with overinvestment in machinery may have conditioned grain-area lenders against this type of loan. Many lenders preferred to have machinery purchased on contract, and to finance the machinery dealer. Hence, merchant credit could provide a source of funds not considered in this study.

There were also differences between areas. Livestock lenders gave more weight to asset-creating loans than did lenders in the grain area. This apparently greater emphasis on collateral may be the result of more experience with feeder-cattle loans, which create assets. Grain-area lenders, on the other hand, have much more lending experience with fertilizer and operating expense, so they tend to discount these loans less and are willing to take other assets as collateral. These factors may also explain the higher machinery loans in the livestock area.

Production credit associations in both areas offered larger loans for machinery and buildings than did banks. The production credit associations were able to do so because they make two- or three-year loans, while banks ordinarily offered only a one-year term with renewal.

No systematic variation was detected in terms of loan resulting from varying proposed use of funds. However, terms did vary between lenders, and for borrowers from the same lender with different asset positions.

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APPENDIX I: AVERAGE LOAN LIMITS

The following table summarizes the mean loan amounts obtained. The number in parenthesis below each figure is its standard deviation. A large number indicates great variability of the individual answers included in the estimate of the mean amount.

Area and agency	Purpose					
	Operat- ing	Machin- ery	Feeder cattle	Build- ing	Ferti- lizer	All purposes
	<i>dollars</i>					
Livestock area						
Small banks. . . .	1,478 (694)	1,167 (1,687)	6,128 (2,774)	322 (524)	624 (355)	1,944
Large banks. . . .	2,212 (665)	1,725 (1,655)	7,581 (2,134)	1,100 (717)	875 (226)	2,699
PCA.	2,500 (354)	3,700 (1,093)	6,000 (612)	1,550 (966)	972 (231)	2,944
All agencies. . . .	1,952 (761)	1,861 (1,830)	6,657 (2,391)	852 (854)	786 (323)	2,422
Grain area						
Small banks. . . .	2,167 (787)	844 (1,001)	5,944 (2,754)	867 (680)	934 (472)	2,151
Large banks. . . .	1,837 (715)	487 (734)	4,975 (2,298)	1,075 (1,105)	1,591 (469)	1,993
PCA.	1,775 (618)	1,500 (728)	7,000 (4,677)	1,850 (350)	1,375 (453)	2,700
All agencies. . . .	1,966 (944)	833 (931)	5,776 (3,157)	1,133 (904)	1,268 (550)	2,195
Both areas, all agencies.	1,959 (855)	1,347 (1,541)	6,316 (2,724)	992 (890)	1,027 (514)	2,309

APPENDIX II: ANALYSIS OF VARIANCE

A split-split plot, completely randomized design with unequal number of replications was indicated by the sample design. Factors in the analysis were designated as follows:

A = area in the state.

S₁ = banks without a competitive lender in the same town.

S₂ = banks with a competitive lender in the same town.

S₃ = production credit association offices.

P₁ = loan for general operating expenses.

P₂ = loan for machinery purchase.

P₃ = loan for feeder cattle.

P₄ = loan for building expenses.

P₅ = loan for commercial fertilizer.

Area represents the main plot. Within each area, the three types of lending institutions are subplots. The five loan purposes considered in each institution are the sub-subplots. There were nine replications for S₁ combinations, eight for S₂, and four for S₃.

The following abbreviated analysis of variance table presents the comparisons that are statistically significant.

Source of variation	Degrees of freedom	Mean square	F ratio
Subplot			
S ₁ and S ₂ vs S ₃	1	13,025,984	4.55**
A x S ₁ vs S ₂	1	8,827,100	3.08*
Error at subplot level.....	20	2,863,986	
Sub-Subplot			
P ₃ , P ₄ and P ₅ vs P ₁ and P ₂	1	93,073,018	41.40***
P ₃ vs P ₂ and P ₄	1	18,246,696	8.12***
P ₂ vs P ₄	1	713,060,357	317.22***
A x P ₃ , P ₄ , and P ₅ vs P ₁ and P ₂	1	7,887,378	3.51*
A x P ₁ vs P ₅	1	9,002,976	4.00**
A x S ₁ and S ₂ vs S ₃ x P ₂ vs P ₄	1	9,944,202	4.42**
Error at sub-subplot level.....	144	2,247,855	

Significance level: * ten-percent level.

** five-percent level.

*** 2.5-percent level.





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